REMARKS

This Amendment is being filed in response to the Office Action mailed December 15, 2006. For the following reasons this application should be allowed and the case passed to issue. No new matter is introduced by this amendment. Support for the amendment to claim 15 is found canceled claims 16 and 17.

Claims 1, 11-15, and 18 are pending in this application. Claims 1 and 11-18 have been rejected. Claim 15 is amended in this response. Claims 2-10 were previously canceled. Claims 16 and 17 have been canceled in this response.

Information Disclosure Statement

Applicants respectfully request the Examiner to consider the information disclosure statement filed December 1, 2006, and return an initialed copy of the PTO-1449 form with the next official action.

Claim Rejections Under 35 U.S.C. § 103

Claims 1, 11-16, and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawakami et al. (U.S. Pat. No. 6,395,423) in view of Sun (U.S. Pat. Pub. No. 2003/0152828) and further in view of Kotato et al. (U.S. Pat. Pub. No. 2004/0101763). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested. The following is a comparison between the present invention, as claimed, and the cited prior art.

The Examiner asserted that Kawakami et al. disclose a secondary battery with an insulative film covering the surface of the positive pole through which ions can pass and the negative pole also has a film on its surface. The protective film on the negative pole activating material comprises an inorganic filler such as an oxide, and an organic polymer binder. The Examiner acknowledged that Kawakami et al. is silent as to the porosity of the insulating film.

The Examiner relied on Sun's teaching of a heat-activatable microporous membrane comprising an inorganic oxide filler which has a porosity of from about 25 to about 75% to conclude that a porosity within this range would result in a higher charge-discharge rate capability of the battery. The Examiner relied on Kotato et al.'s teaching of a separator with a porosity of 30 to 60% and a pore size of 0.43 μm to assert that the separator porosity and pore size would have been obvious to provide a separator with excellent electrolytic solution holding properties and satisfactory separator strength. The Examiner averred that Kawakami et al. disclose polycrystalline oxide filler particles. The Examiner alleged that claims 12, 15, and 16 are product-by-process claims.

The combination of Kawakami et al., Sun et al., and Kotato et al., however, does not suggest the claimed non-aqueous electrolyte secondary battery. None of the cited references suggest the claimed relation between the ratio of actual volume to apparent volume of the separator (R) and porosity of the insulating layer (P), as required by claim 1.

Kawakami et al. are not interested in the porosity of the porous insulating film. Although Sun discloses the porosity of the film corresponding to the porous insulating film, the combination of the separator and the porous insulating film is not disclosed. Kotato et al. disclose the porosity of the separator, but do not disclose the combination of the separator and the porous insulating film. In other words, Sun only discloses the porosity of the porous insulating film, and Kotato et al. only disclose the porosity of the separator. However, in order to obtain the appropriate relations between P and R, as required by the present invention, examination and experimentation of both the porosity of the separator and of the porous insulating film would have to have been carried out in those batteries with both the separator and the porous insulating film.

Though Sun may teach (paragraph [0062]) that "the higher the porosity of the separator, the better", as noted in the specification of the present invention (page 5, line 21 to page 6, line 9), the higher porosity of the separator and the porous insulating film does not necessarily mean the better. Sun is clearly not aware of the disadvantages caused by high porosity, as discovered by the present inventors.

Further, Kawakami et al. and the present invention also differ in purpose. Kawakami et al. aims to prevent the occurrence of an internal short circuit caused by dendrites grown on the negative electrode reaching the positive electrode, whereas the present invention aims to prevent the occurrence of a thermal runaway in the case of an internal short circuit. The prevention of thermal runaway is based on the synergistic effects of the separator and the porous insulating film, and the synergistic effects obtained when R-P satisfies $-0.10 \leq R\text{-}P \leq 0.30$, as required by claim 1.

Kawakami et al., Sun, and Kotato et al. do not suggest the unexpected improvement in battery characteristics disclosed in the present specification when the claimed relation between R and P is met. For example, Tables 2 and 3 of the present specification disclose that at $R\text{-}P < 0.30$ an unexpected improvement in discharge capacity results and at $R\text{-}P > -0.10$ high internal resistance and satisfactory shut-down effect is obtained.

As regards claim 12, the Office Action erroneously concluded that Kawakami et al. discloses polycrystalline inorganic oxide particles. There is no disclosure in Kawakami et al. that the inorganic glass structure is polycrystalline. The Office Action contains no support for the assertion that Kawakami et al. teach **polycrystalline** inorganic oxide particles.

According to Kawakami et al. (column 7, line 65 to column 9, line 21) of D1, the film on the negative electrode is made by the sol-gel method. The Kawakami et al. sol-gel film

comprises oxides. Therefore, the film in Kawakami et al. appears to enamel-like. The film may sometimes includes polymer, but since a colloidal solution is used as the raw material, the composite of the "polycrystalline particles" and the "film binder," as required by claim 12, are not produced.

Additionally, according to column 36, line 34 to column 38, line 34 of Kawakami et al., the film on the positive electrode is made by the laser CVD method, the sputtering method, and the plasma CVD method, other than the sol-gel method. With these methods, no composite material of the "polycrystalline particles" and the "film binder" is produced, as required by claim 12.

Further, the micropores in the Kawakami et al. film appear to be too small to be measured by a mercury intrusion porosimeter, unlike those in claim 12. This makes it possible to prevent the reaction between the lithium metal negative electrode, water, and oxygen, as is explained in column 7, line 66 to column 8, line 6 of Kawakami et al. The film of the present invention has a D90 of not less than 0.15 μm, therefore, penetration of water and oxygen is not prevented.

As taught in paragraphs [0031] to [0032] and Table 2 of Sun, using the water-soluble "pore former" causes a porous film with pores of, for example, 0.43 μm to be produced. However, because the formation of the porous film in Sun necessitates a water washing process, the film has to be formed independently from the electrodes. An independent film ordinarily includes a large amount of resin component. Therefore, the porous film in Sun is quite different from the porous insulating film in Claim 12 of the present invention, which requires not greater than 4 parts by weight of the "film binder" per 100 parts by weight of the "inorganic oxide filler". Because Sun requires a process of washing with water to remove the water-soluble

"pore former", it is not possible to combine Sun with Kawakami et al., in which a film is formed on the electrode.

Clearly, Kawakami et al., Sun, and Kotato et al. do not suggest the porous insulating film wherein 90% cumulative volume pore size D90 in a pore size distribution measured by a mercury intrusion porosimeter is not less 0.15 μm. Furthermore, as Sun preferably teaches a binder content of much greater than 4%, there is no suggestion in Sun that at a binder content of not greater than 4% the claimed volume pore size would result. Claim 12 is further distinguishable over the prior art in view of the evidence of unexpected results in Table 5 of the present invention. Batteries according to claim 12 provide <u>unexpected improvement</u> in discharge capacity ratio.

As regards independent claim 15, Kawakami et al. disclose (column 8, lines 4-6) that "the direct contact between the lithium (negative pole) and the electrolytic solution does not take place". In other words, in the "adhering interface" of Kawakami et al., there are no voids at the "adhering interface", or voids that are formed are unable to retain the electrolyte, as required by claim 15.

Furthermore, in Sun, the electrode and the porous film independent of the electrode are attached by pressure application and heat treatment (para. [0026]). In para [0035], it is noted that "the binding between the microporous membrane and electrode is a result of physically fusing the hot-melt adhesive (resin component), and therefore, it provides a permanent and stronger bond than that provided by the prior art". That is, the voids are filled with the hot-melt adhesive.

Neither Kawakami et al., Sun, nor Kotato et al. suggest the non-aqueous electrolyte secondary battery wherein a void capable of retaining the non-aqueous electrolyte is formed on an adhering interface where the porous insulating film adheres to the electrode surface, the

amount of the film binder contained in the porous insulating film is not greater than 4 parts by weight per 100 parts by weight of the inorganic oxide filler, a void size distribution of the adhering interface measured by a mercury intrusion porosimeter has a peak in a region ranging from 1 to 4 μm, and the electrode surface to which the porous insulating film adheres has an average surface roughness Ra of 0.1 to 1 μm, as required by claim 15.

Furthermore, the combination of Kawakami et al., Sun, and Kotato et al. do not suggest the unexpected improvement in discharge capacity ratio while maintaining satisfactory adhesion of the porous insulating layer to the electrode obtained by batteries with the claimed void size distribution and electrode surface roughness, as shown in Table 7 of the present specification

Claim 17 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawakami et al. in view of Sun and Kotato et al. and further in view of Ota et al. (U.S. Pat. No. 6,365,300). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Examiner acknowledged that Kawakami et al., Sun, and Kotato et al. do not disclose the surface roughness of the electrode. The Examiner maintained that Ota et al. disclose lithium secondary batteries wherein the negative electrode has a surface roughness within the claimed range. The Examiner considered it obvious to use a negative electrode with the surface roughness as disclosed by Ota et al. to provide good bonding of the electrolyte layer.

Though claim 17 has been canceled, the limitations of claim 17 have been added to claim 15. The combination of Ota et al., Kawakami et al., Sun, and Kotato et al. does not suggest the claimed non-aqueous electrolyte secondary battery as Ota et al. do not cure the deficiencies of Kawakami et al., Sun, and Kotato et al. Ota et al. do not suggest the unexpected improvement in discharge capacity ratio while maintaining satisfactory adhesion of the porous insulating layer to the electrode.

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In addition, the Examiner's erroneous conclusion that claims 12, 15, and 16 are product-by-process claims is traversed. A product-by-process claim is a claim in which the product is claimed by the manner in which it is made. Clearly, independent claims 12 and 15 are not product-by-process claims.

The dependent claims are allowable for at least the same reasons as the independent claims from which they depend and further distinguish the claimed non-aqueous electrolyte secondary battery.

In light of the above Amendment and Remarks, this application should be allowed and the case passed to issue. If there are any questions regarding these remarks or the application in general, a telephone call to the undersigned would be appreciated to expedite prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

CERTIFICATION OF FACSIMILE TRANSMISSION

I HEREBY CERTIFY THAT THIS PAPER IS BEING FACSIMILE TRANSMITTED TO THE PATENT AND TRADEMARK OFFICE ON THE DATE SHOWN BELOW

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Date: March 15, 2007

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WDC99 1363363-1.043888.0428